

CANDIDATE
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MARINE SCIENCE

9693/04

Data-Handling and Free-Response

May/June 2014

Paper 4

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
1	
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Total	

This document consists of **12** printed pages.

Section A

Answer **all** questions.

- 1 Fig. 1.1 shows a photograph of a loggerhead turtle, *Caretta caretta*.



Fig. 1.1

- (a) An investigation was carried out into the effect of temperature on egg development of the loggerhead turtle.

Turtle nests were randomly selected on a beach on the island of Zakynthos, Greece.

The mean daily temperature of each nest was recorded.

The length of time from egg laying until hatching was recorded for each nest.

The results are shown in Table 1.1.

Table 1.1

mean daily temperature / °C	mean time to hatching / days
26.0	79.0
26.5	78.0
27.0	70.0
27.5	65.5
28.5	62.0
29.0	59.0
30.0	57.5
31.5	56.0
33.0	no eggs developed

Describe the relationship between the temperature and the time taken for the loggerhead turtle eggs to hatch.

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[1]

- (b) A further laboratory experiment was carried out into the effects of temperature on the sex of the turtle hatchlings.

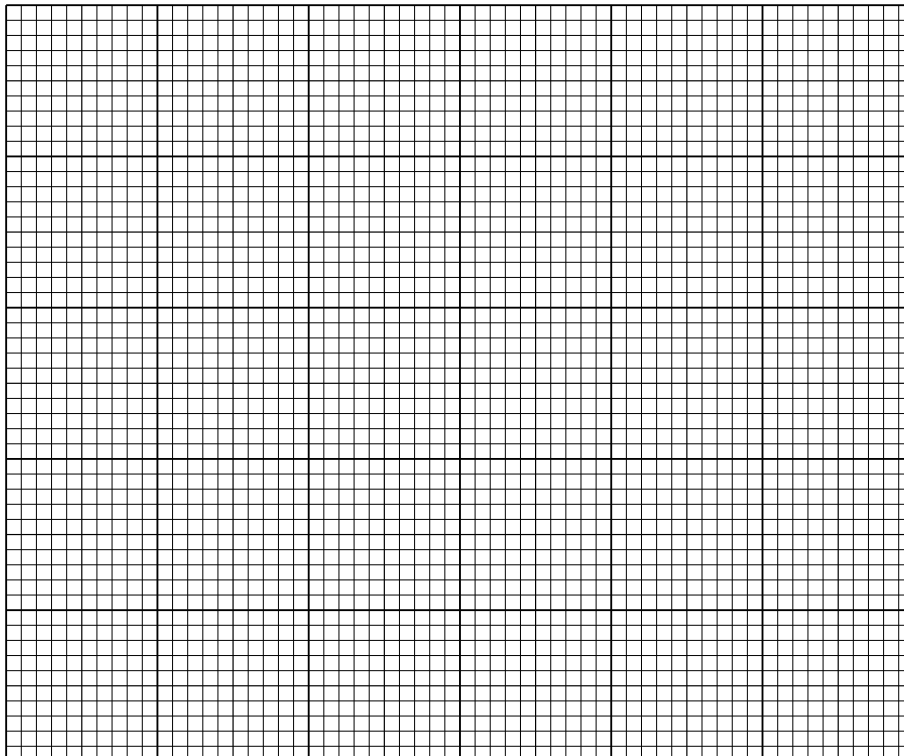
Eggs were incubated at a range of temperatures between 26 °C and 32 °C and the percentage of female hatchlings determined.

The results are shown in Table 1.2.

Table 1.2

temperature / °C	percentage of hatchlings that are female
26	10
27	15
28	20
29	50
30	70
31	85
32	90

- (i) Plot a graph of percentage of hatchlings that are female against temperature. Join the points with straight lines.



[3]

- (ii) In a conservation study, turtle nests were selected at random locations on a beach and the mean daily temperature of the nests monitored throughout a three month period.

The temperatures are recorded in Table 1.3.

Table 1.3

month	mean daily temperature / °C	percentage of females
April	28.2	
May	29.8	
June	30.5	

[1]

Use your graph to predict the likely percentage of female hatchlings and record these in Table 1.3.

- (c) On the Greek island of Zakynthos, loggerhead turtles have been the subject of many conservation efforts in recent years.

- In loggerhead turtles, the breeding season occurs between the months of April and June.
- Mating occurs in the open sea.
- After mating, the females then swim towards the beaches to lay their eggs.
- The males remain in the open sea.
- The females must haul themselves up exposed beaches to reach suitable sand for nesting.
- Hatchlings migrate back to the sea to feed on a mixed diet that is highly seasonal.

- (i) As part of the conservation programme, loggerhead turtles are also caught at sea and counted. During the period 2005–2007, the percentage of adult females found in the sea was in the range 48% to 52%, while the mean percentage of female hatchlings was found to be within the range 65% to 68%.

Using the information above, suggest reasons for these differences in percentages of females between the adult turtles and the hatchlings.

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.....[3]

- 2 Otoliths are small bony structures found inside the heads of most bony fish. They have major functions in both hearing and balance.

In many species of fish with seasonal growth patterns, annual growth rings appear in the otoliths. These rings can be seen clearly when viewed under a microscope and they can give an indication of the age of a fish.

It has been suggested that the thickness of each ring is proportional to the growth rate of the fish.

Biochemical analysis of otoliths can also be carried out to determine the approximate geographical locations the fish has visited.

Fig. 2.1 shows an otolith taken from the head of an Atlantic codfish when viewed through a microscope.

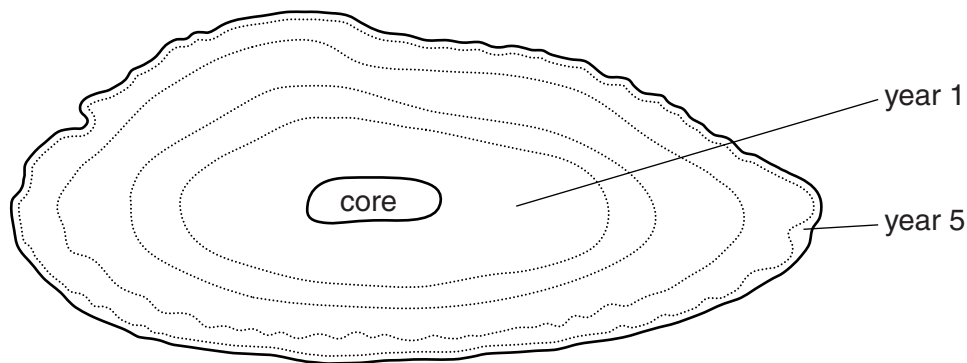


Fig. 2.1

- (a) (i) Use a ruler to measure the maximum length of the first year of growth in mm from the outer edge of the core, as shown on Fig. 2.1.

Record the answer below.

Maximum growth length of year 1 [1]

(ii) The magnification of the image in Fig. 2.1 is $\times 10$.

Using the formula below, calculate the actual length of year 1 growth as shown in the image in Fig. 2.1.

$$\text{magnification} = \frac{\text{image length}}{\text{actual length}}$$

Actual length [1]

(b) Use Fig. 2.1 to compare the growth rate of the cod in year 1 with subsequent years. Suggest reasons for differences.

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Section B

Answer **all** questions.

3 (a) With reference to named examples, explain the meaning of each of the following terms.

(i) *euryhaline*
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..... [2]

(ii) *osmoconformer*
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(b) Explain why marine fish need to regulate their water and ion content and describe how they do this.

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(c) Describe the life cycle of the giant clam.

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[5]
[Total: 15]

